



**TETRA TECH**

March 4, 2008

Ms. Laura Alvey  
Montana Department of Environmental Quality  
Remediation Division  
P.O. Box 200901  
Helena, Montana 59620-0901

**RE: Lost Creek Fan Shallow Aquifer Potentiometric Surface Mapping Report  
Northwest of Kalispell, Montana  
Tetra Tech Project No. 8570003**

Dear Ms. Alvey:

This letter report presents results of groundwater flow mapping (also known as potentiometric surface mapping) conducted by Tetra Tech during December 2007 at the Lost Creek Fan located northwest of Kalispell (Figure 1). Mapping the potentiometric surface of the shallow aquifer of the Lost Creek Fan was completed under Montana Department of Environmental Quality (DEQ) Contract No. 407036 in general accordance with Task Order No. 11 approved by DEQ and signed by Tetra Tech November 6, 2007. The following sections present background information, methods, and results of the December 2007 mapping activities. Referenced figures and tables are contained in Attachments A and B, respectively. Selected well logs and photos are contained in Attachments C and D, respectively.

### **BACKGROUND INFORMATION**

DEQ has been investigating a large nitrate plume or plumes in the shallow aquifer which underlies the Lost Creek Fan alluvial fan. For the purposes of this study, DEQ considers shallow groundwater wells in this area to be 150 feet deep or less. Groundwater flow direction has been mapped previously on a regional scale by others (Patton et al., 2003, Konizeski et al, 1968). General groundwater flow direction in the vicinity of the Lost Creek Fan is to the east towards the Stillwater River. DEQ developed this project to provide an up-to-date potentiometric surface map of the shallow alluvial aquifer underlying the Lost Creek Fan to assist with the identification of potential point-sources and non-point sources of nitrate.

Depth-to-water (DTW) readings were to be collected in approximately 30 shallow wells and 10 deep wells. A succinct report was to be generated that included a summary of methods and results, as well as a potentiometric surface map of the shallow aquifer.

### **Geology and Hydrostratigraphy of the Lost Creek Fan**

The site is located within the northern Flathead Valley approximately 12 miles northwest of Kalispell, Montana; an area bounded by the Whitefish and Swan mountain ranges to the north and east, and the Salish Mountains to the west (Figure 1).



During the last ice age, this portion of the Flathead Valley was filled with a glacier thousands of feet thick (Alt 1984). This mass of ice shaped the surrounding landscape, leaving behind a linear, flat-bottomed valley, extending north and south several hundred miles. Glacial advances and retreats deposited sediments across the valley floor ranging in size from boulders to clay. In more recent times, the northern Flathead Valley received sediment derived from the surrounding mountains and reworked glacial deposits. Rivers and streams, draining into Flathead Valley and Flathead Lake, reworked glacial derived clay, silt, sand and gravel into thick sequences of fluvio-glacial deposits up to several hundred feet thick (Konizeski et al. 1968). Figure 2 portrays the general basin fill surficial geology in the study area (Harrison et al. 1992).

The Flathead Valley can be further divided into various subarea basins. Within these subareas there are multiple hydrogeologic units consisting of basin fill that is either water producing (aquifers) or non-water producing (confining units). Five hydrogeologic units are common to most subareas:

- Shallow alluvium (gravel, sand, silt, and clay deposited by streams) either exposed at or near the land surface (shallow alluvial aquifers),
- Till and fine-grained glacial-lake sediments (confining units),
- Alluvium within or below the confining units (intermediate or deep alluvial aquifers),
- Tertiary sediments or sedimentary rock (Tertiary aquifers), and
- Fractured bedrock (bedrock aquifers).

It is important to note that in many areas of the Flathead Valley, deep alluvial aquifers appear to be well protected from surficial contamination sources by nearly continuous confining units of till and glacial-lake deposits. However in localized areas, such as near the Lost Creek Fan northwest of Kalispell, the protective cover may be missing and deep alluvial aquifers may be susceptible to contamination (Patton et al. 2003).

Well logs for deep and shallow wells identified in the study area were reviewed to obtain the general lithology of the subsurface across the study area (Attachment C). The following table summarizes the lithology in three reference wells (Table 1). This lithology typifies glacial and fluvioglacial deposits which contain interbedded clay, silts, gravel and cobbles.

**Table 1**  
**General Lithology of Reference Wells in the Lost Creek Alluvial Fan**

GWIC #84528	GWIC #148209	GWIC #207031
0 to 70 feet; Gravel and Boulders	1 to 90 feet; Clay, Gravel, and Cobblestone	2 to 68 feet; Clay, Gravel, and Cobbles
70 to 80 feet; Sand, Gravel, and Water	90 to 120 feet; Gravel and Water	68 to 70 feet; Green Boulder
80 to 88 feet; Clay and gravel		70 to 230 feet; Tan Clay, Gravel, Cobbles and Small Boulders
		230 to 275 feet; Cemented Sand, Gravel and Water

## METHODS AND RESULTS

Traditionally, DTW measurements are collected by lowering a probe down the well. However, in an effort to avoid introducing foreign objects or cross contamination of domestic supply wells included in the survey, Tetra Tech recommended and DEQ approved the use of a sonic depth-to-water meter. The sonic meter is accurate to 0.2 feet, whereas the traditional down-hole probe is accurate to 0.01 feet. However, the sonic meter has the advantage of not requiring entry into the well casing, which obviates the need for decontamination. Given the large size of the Lost Creek Fan study area (approximately 8 square miles) and the widely-spaced distribution of the monitoring well network, the difference in accuracies in the two methods is insignificant.

Work conducted during November and December 2007 consisted of the following:

- Tetra Tech conducted a preliminary reconnaissance of the study area with DEQ on November 26, 2007. Work consisted of getting acquainted with general location of the study area and identifying specific well locations. DEQ provided Tetra Tech a list of possible wells to be included in the DTW survey. Additionally, any wells which would likely require confined-space-entry were identified and discussed. Six wells were identified for confined-space-entry.
- Tetra Tech met with DEQ personnel on December 19 and 20, 2007 to conduct the DTW survey. Tetra Tech used a model 200 sonic water level meter manufactured by Ravensgate Corporation. The instrument was calibrated each morning by using a standard electronic well probe in the unused Fenley irrigation well on Scenic Drive. An *In-situ* "Baro" probe was placed in this well to measure the change in barometric pressure over the two day period.

- Tetra Tech and DEQ surveyed DTW in 30 of the 36 shallow wells in the locations shown in Figure 2. Four deep wells were also measured.
- Wells that required confined space entry were checked first. Tetra Tech used an RKI Eagle combustible gas indicator to check each confined space prior to and during entry for combustible atmospheres and % oxygen. Three of the wells identified for confined-space-entry, 3745FTM, 84527 and 84526 had no access port to allow the sonic meter probe to enter the well. These wells were not included in the survey. Additionally, Tetra Tech was unable to measure DTW in well 2111Church because both times the well was visited the pump was running.
- Well number 703031 was mislabeled on the original well information sheets provided to Tetra Tech by DEQ, and has been correctly changed to number 84525. This well has a continuous water level recorder maintained by the Montana Bureau of Mines and Geology GWIC center. GWIC staff have informed DEQ and Tetra Tech that the water level recorder was not functioning during the time period around December 19 and 20, 2007. Therefore, no data is available from well 84525 and it cannot be included in the potentiometric surface map. GWIC has indicated that the well's recorder has been repaired, and data from this well should be available for inclusion if additional flow maps are made.

### **Groundwater Elevation and Flow**

Tetra Tech personnel measured DTW in 30 shallow and 4 deep wells on December 19 and 20, 2007. DEQ had the study area wells and one surface water point surveyed for location and elevation by a subcontractor (DJ&A, a Montana licensed surveyor). Tables 2 and 3 present water level data and survey data collected at the site, respectively. Figure 3 represents a potentiometric surface map of the shallow aquifer underlying the Lost Creek Fan. A summary of the data collected and interpretations of groundwater flow direction and gradient follow:

- Groundwater elevations in December 2007 ranged from 3,092.92 feet above mean sea level (AMSL) in well 1195BRR to 2,984.61 feet AMSL in well 84486.
- Based on information collected with the "baro" probe, the barometric pressure decreased by 0.03 feet (of water) during the actual measurement period on December 19, 2007 (rising water levels) and increased by 0.03 feet during the December 20, 2007 sample period (falling water levels). The total barometric pressure change over the two day period was 0.16 feet; which is less than the accuracy of the sonic water level meter, thereby having negligible effects on the DTW readings. Barometric pressure corrections were not performed on the data and were not incorporated into the interpretation of the groundwater flow direction.
- Tetra Tech compared the well logs and DTW measurements in a "nested" well pair consisting of shallow alluvial aquifer well (GWIC #84525) and a deeper alluvial well (GWIC #168369) (see well logs in Appendix C). The

wells were co-located at 1925 Church Drive (Figure 2). GWIC well #84525 is 73 feet deep well with a static water level of 52 to 58 feet based on data collected the continuous recorder data from the well (monitored by others). GWIC well #168369 is 235 feet deep and had a measured water level of 202.6 feet. The lithology for the deep well indicates a potential confining layer from 78 feet to 208 feet BGS (brown clay gravel and cobbles- glacial till). Based the presence of a thick sequence of glacial till and the disparity between static water levels in the shallow and deeper aquifer, Tetra Tech believes there is limited connectivity between the shallow and deep alluvial aquifers at this location. However, it should be noted that the lateral extent of this thick sequence of glacial till is not known and could be absent in other areas of the alluvial fan.

- A potentiometric surface map was approximated using GIS Spatial Analyst Spline Method and refined by hand (Figure 3). Equal potential lines are shown on 10-foot intervals and are dashed were they are approximate or inferred. Interpretation of the data and generation of the potentiometric surface plot was strongly biased by surface topography utilizing the professional judgment of a Tetra Tech hydrogeologist.
- Several anomalous points were observed during sampling or data interpretation and as a result were removed from consideration of potentiometric surface.
  - Well 905 Clark: erroneously low. The water level measurement in well 905, 63.2 feet below measuring point elevation, was markedly different from other wells in the vicinity which had static water levels ranging from 24.5 to 38.6 feet. Based on the well log provided by GWIC (#162428), this well is completed in a cemented sand and gravel aquifer at a depth greater than other well completions in this area of the Lost Creek Fan; therefore it may be hydrostratigraphically isolated from the shallow alluvial aquifer. The water level in the well was surveyed in the mid-afternoon, therefore it is unlikely that this well's measurement reflects a transient condition due to groundwater pumping or other well interference. This, coupled with the fact that the static water level measured during the survey (63.2 feet) is similar to its well completion static water level (65 feet) provided by GWIC, means that the elevation measured during the survey likely represents static conditions of a deeper aquifer.
  - Well 2335WVD-02: erroneously low. The well was pumping during survey measurement.
  - Well 167042 is apparently a deep well, not previously identified as such. The static water level was 189.1 feet below the casing elevation. In the GWIC database, Well 167042 is listed as being 100 feet deep. Either the GWIC information for this well is incorrect, or DEQ has assigned this well the incorrect GWIC number. DEQ will follow-up on this issue in the future.
- In general, groundwater flow direction in December 2007 followed the topographic slope across the alluvial fan; to northeast in the northern portion

of the fan, to the east in the central portion of the fan, and to the southeast in the southern portion of the fan.

- It appears that the hydraulic gradient also increases with increasing topographic slope; the gradient in the west central part of the alluvial fan was approximately 0.54%, and the gradient across the toe of the Lost Creek Fan in the eastern portion of the study area was approximately 1.6%. The average hydraulic gradient taken from the mouth of Lost Creek canyon to the floodplain of the Stillwater River was approximately 0.89%.
- The shoreline of a pond in the SE1/4 of Section 15, Township 29N Range 22W was surveyed. The surface elevation of this pond was comparable to nearby groundwater elevations; however according to Tetra Tech staff scientist the pond was receiving discharge from nearby dewatering operations during sampling. Regardless, there is at least ancillary evidence that the pond locations on the toe of the alluvial fan are in communication with groundwater. This evidence is supported by statements from Landowners in the vicinity of the ponds and their observations over many years of living in the area.

Following your review, please call Don M. May or William Craig at 406.543.3045 with any questions or comments. Tetra Tech will incorporate your comments into the report and submit five copies of the Final Report to DEQ. We appreciate the opportunity to work with DEQ on this project.

Sincerely,

Don M. May  
Environmental Scientist

William Craig  
Project Manager

Attachments: A Figures 1, 2 and 3  
B Tables 1 and 2  
C Well Logs  
D Photolog

References:

**Alt, D.D., 1984.** Profiles of Montana Geology. Montana Bureau of Mines and Geology, Special Publication 89, 158 p.

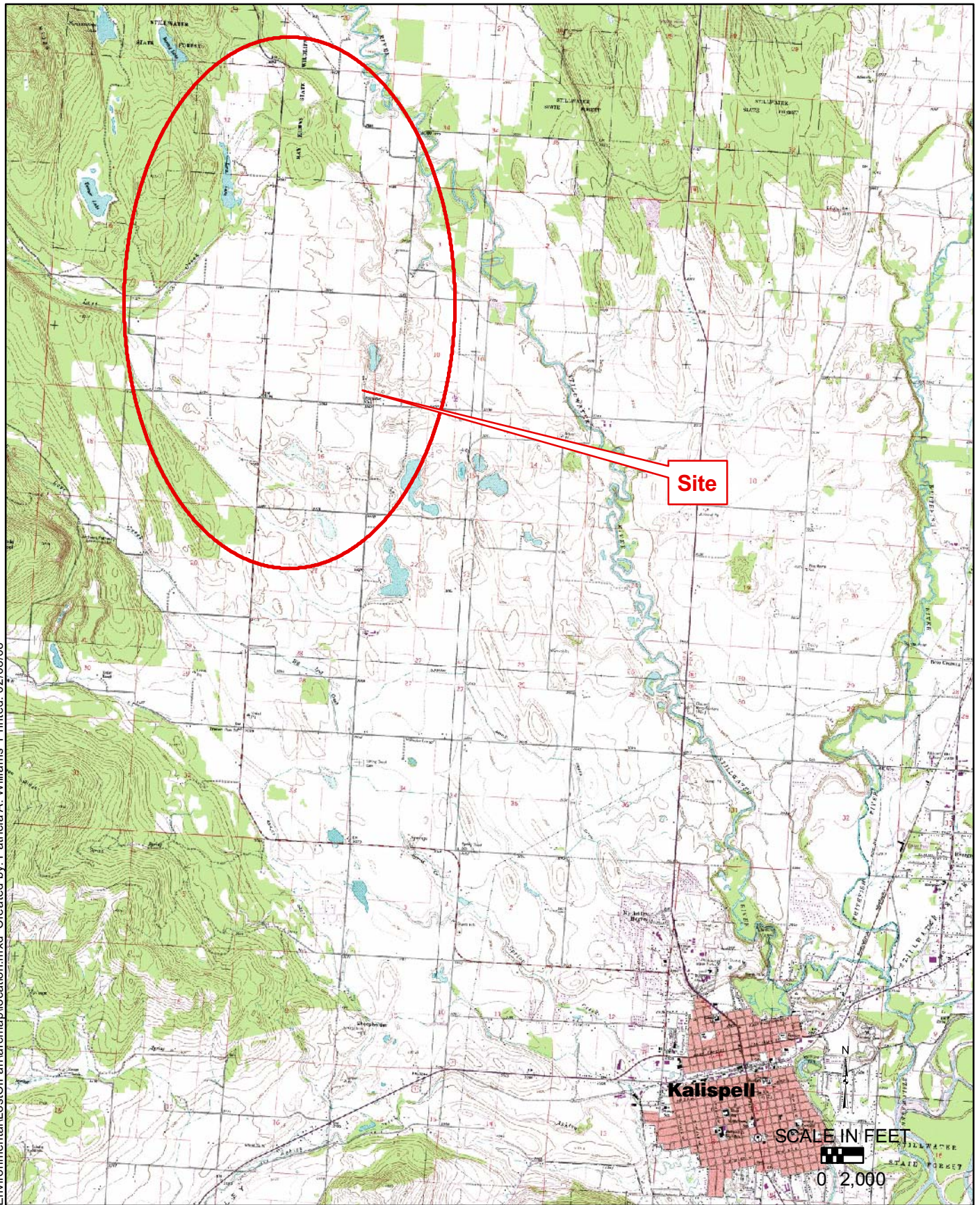
**Harrison, J.E., Cressman, E.R., Whipple, J.W., 1992,** Geologic and structure maps of Kalispell 1 x 2 degree quadrangle, Montana and Alberta, British Columbia, United States Geological Survey: Miscellaneous Geologic Investigation 2267, 1 sheet(s), 1:250,000.

**Konizeski, R.L., A. Brietkrietz and R.G. McMurtrey, 1968,** Geology and Ground Water Resources of the Kalispell Valley, Northwestern Montana. Montana Bureau of Mines and Geology, Bulletin 68, 42 p.

**Thomas W. Paton, Larry N. Smith, John I. LaFave,** Ground-Water Resources of the Flathead Lake Area: Flathead, Lake, Sanders, and Missoula Counties, Montana. Montana Bureau of Mines and Geology, January 2003. Information Pamphlet No. 4.

**ATTACHMENT A**  
**Figures**





USGS 7.5' Rhodes Topographic Quadrangle

**Figure 1**  
**Location Map**  
**Kalispell, Montana**  
**Lost Creek Fan**





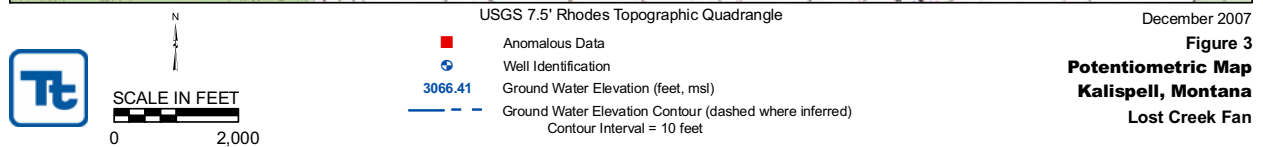
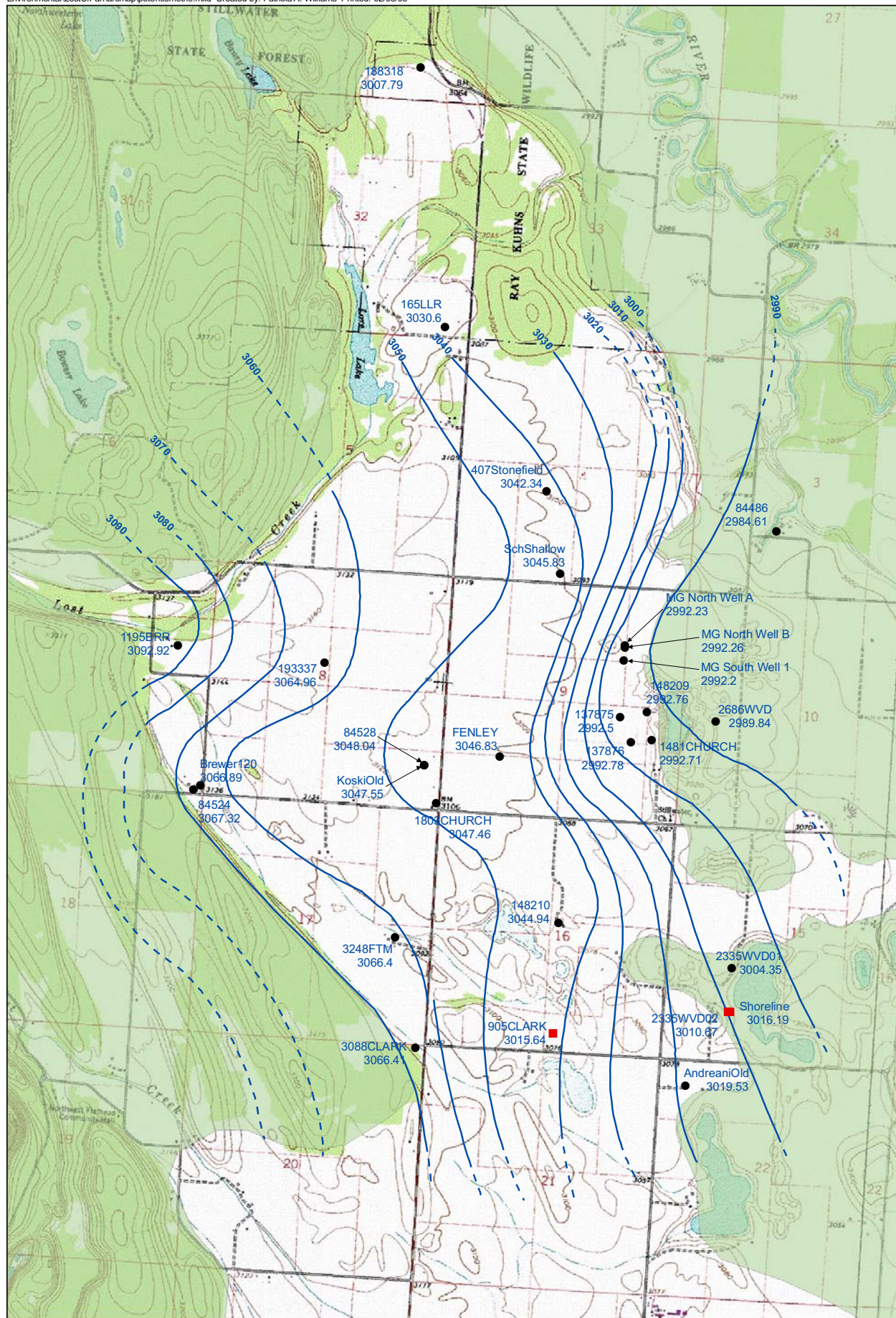
Geology



- Qal - Alluvial deposits (Holocene)
- Qg - Glacial and fluvioglacial deposits (Pleistocene)
- Ql - Lake sediments (Pleistocene)
- Ye - Empire Formation (Middle Proterozoic)

**Figure 2**  
**Geology Map**  
**Kalispell, Montana**  
**Lost Creek Fan**





**ATTACHEMENT B**  
**Tables**

**TABLE 2  
LOST CREEK FAN**

	GWIC ID # or other ID	DTW	Depth (feet)	Well address
1	188318	70.2	147	4670 Farm-to-Market Rd
2	84526	Only 1 access port, could not move electrical wires	74	3580 Farm-to-Market Rd
3	SchShallow	56.3	Shallow	375 Lost Creek Dr.
4	Brewer120	74.8	120	810 Bald Rock Rd
5	84524	71.5	78	810 Bald Rock Rd
6	84528	66.0	88	1825 Church Dr.
7	KoskiOld	66.5		1825 Church Dr.
8	137876	94.2	107	1489 Church Dr.
9	137875	94.6	85	1491 Church Dr.
10	148210	38.6	75	1610 Church Dr.
11	2335WVD01	51.4	85	2335 W. Valley Dr.
12	2335WVD02	13.95 Pump is running	30	2335 W. Valley Dr.
13	Shoreline	NA	NA	2335 W. Valley Dr.
14	84490	Frost free goes through well cap. No access.	88	1201 Stonefield Lane (used to be 405 Lost Creek Drive)
15	122334 (initially labeled 407 Stonefield)	58.2	83	1190 Stonefield Lane (used to be 407 Lost Creek Drive)
16	84525 (previously incorrectly labeled 703031)	GWIC Well	70	1925 Church Rd, 59901-7038
17	84527	No access port open.	88	3570 Farm-to Market Rd
18	148209	90.2	120	1483 Church Dr.
19	167042	189.1 Check TD on GWIC.	100	400 Lost Creek Rd
20	1195BRR	57.9	90	1195 Bald Rock Rd
21	1803CHURCH	60.0	80	1803 Church Dr
22	1481CHURCH	93.3	125	1481 Church Dr
23	905CLARK	63.2	125	905 Clark Dr
24	3745FTM	Rope in port too big, no access.	80	3745 Farm-to-Market Rd
25	3088Clark	28.6	Shallow	3088 Clark Drive
26	193337	73.0	100	718 Lost Creek DR
27	165LLR	74.2	95	165 Lore Lake Rd
87	2686WVD	81.0	*	2686 West Valley Drive
29	3248FTM	24.55	*	3248 Farm-to-Market Rd
30	FENLEY	62.4	*	On west side of Scenic Drive Loop (dirt road off Church Dr), in field N of old abandoned irrigation equipment
31	84486	15.1	142	785 Fox Farm Rd.
32	MG South well #1	99.64	106	S side of Lost Creek Drive, across street from 375 LCD
33	MG North well #2 B Eastern well, 8"	98.88	120	S side of Lost Creek Drive
34	MG Northern well #2 A Western well 6"	98.34	104	S side of Lost Creek Drive
35	AndreaniOld	50.6	90	2015 West Valley DR
36	1397Church	No access port	*	1397 Church Dr
37	2111 Church	Pump running both times we checked	80	2111 Church

Notes:

\* = Accurate depth information is not available, but well is assumed to be less than 150 feet deep.



TABLE 3

DEQ LOST CREEK RESIDENTIAL WELL SURVEY LOCATIONS				
POINT NUMBER	LATITUDE NAD83(CORS96)	LONGITUDE (EPOCH:2002.0000)	ELEVATION (US FEET) Geoid03 NAVD88(CORS)	DEQ/GWIC ID
100	48.2889°N	114.3981°W	3086.01	1481CHURCH
101	48.2906°N	114.3987°W	3082.96	148209
104	48.2902°N	114.4011°W	3087.10	137875
105	48.2903°N	114.3923°W	3070.84	2686WVD
106	48.3022°N	114.3878°W	2999.71	84486
107	48.2752°N	114.3894°W	3058.75	2335WVD01
108	48.2887°N	114.4000°W	3086.98	137876
109	48.2988°N	114.4075°W	3102.13	SchShallow
110	48.2973°N	114.4081°W	3107.13	167042
111	48.2937°N	114.4011°W	3091.84	MG South Well 1
112	48.2945°N	114.4011°W	3091.14	MG North Well B
113	48.2946°N	114.4011°W	3090.57	MG North Well A
115	48.3135°N	114.4195°W	3104.80	165LLR
116	48.2924°N	114.4287°W	3137.96	193337
117	48.2678°N	114.3930°W	3070.13	AndreaniOld
118	48.2725°N	114.3895°W	3024.62	2335WVD02
119	48.2725°N	114.3893°W	3016.19	Shoreline
120	48.2705°N	114.4055°W	3078.84	905CLARK
121	48.2691°N	114.4181°W	3095.01	3088CLARK
122	48.2758°N	114.4206°W	3090.95	3248FTM
123	48.2865°N	114.4189°W	3114.04	84528
124	48.2865°N	114.4189°W	3114.05	KoskiOld
125	48.2842°N	114.4176°W	3107.46	1803CHURCH
126	48.2873°N	114.4120°W	3109.23	FENLEY
128	48.3289°N	114.4232°W	3077.99	188318
130	48.3038°N	114.4092°W	3100.54	407Stonefield
133	48.2929°N	114.4423°W	3150.82	1195BRR
134	48.2844°N	114.4394°W	3141.69	Brewer120
137	48.2841°N	114.4400°W	3138.82	84524
140	48.2773°N	114.4056°W	3083.54	148210
143	48.2842°N	114.4249°W	3120.18	84525 previously incorrectly labeled 703031

Survey provided by DJ&amp;A, contracted to DEQ

**ATTACHMENT C**  
**Well Logs**

# MONTANA WELL LOG REPORT

## Other Options

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Plot this site on a topographic map  
View hydrograph for this site

**Site Name:** CARMALT JEFF AND NUGGET

**GWIC Id:** 84525

**DNRC Water Right:** COO3003-00

### Section 1: Well Owner

**Owner Name**

CARMALT JEFF AND NUGGET

**Mailing Address**

1925 CHURCH ROAD

**City**

KALISPELL

**State**

MT

**Zip Code**

59901

### Section 2: Location

**Township**

29N

**Range**

22W

**Section**

8

**Quarter Sections**

SW¼ SE¼ SW¼ SE¼

**County**

FLATHEAD

**Geocode**

**Latitude**

48.2842

**Longitude**

114.4249

**Geomethod**

NAV-GPS

**Datum**

NAD83

**Altitude**

3120.18

**Method**

**Datum**

**Date**

**Addition**

**Block**

**Lot**

### Section 3: Proposed Use of Water

IRRIGATION (1)

### Section 4: Type of Work

Drilling Method: CABLE

### Section 5: Well Completion Date

Date well completed: Tuesday, May 07, 1974

### Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

**Casing**

**Wall**

**Pressure**

**From To Diameter Thickness Rating Joint Type**

0 73 7

STEEL

**Completion (Perf/Screen)**

**# of**

**Size of**

**From To Diameter Openings Openings Description**

73 73 7

OPEN BOTTOM \*

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 73

Static Water Level: 58

Water Temperature:

### Baller Test \*

120 gpm with feet of drawdown after 4 hours.

Time of recovery hours.

Recovery water level feet.

Pumping water level feet.

\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**

112OTSH - GLACIAL OUTWASH (PLEISTOCENE)

**From To**

**Description**

0

54

CLAY AND STONE

54

67

GRAVEL

67

73

AQUIFER

### Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:**

**Company:** HENDRICKSON

**License No:** WWC-153

**Date**

**Completed:** 5/7/1974

# MONTANA WELL LOG REPORT

## Other Options

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Plot this site on a topographic map

**Site Name:** CARMALT JEFF & NUGGETT  
**GWIC Id:** 168369

## Section 7: Well Test Data

Total Depth: 235  
Static Water Level: 185  
Water Temperature:

## Section 1: Well Owner

**Owner Name**  
CARMALT JEFF & NUGGETT  
**Mailing Address**  
1925 CHURCH DR

**City** **State** **Zip Code**  
KALISPELL MT 59901

## Air Test \*

20 gpm with drill stem set at feet for 1 hours.  
Time of recovery hours.  
Recovery water level feet.  
Pumping water level 230 feet.

## Section 2: Location

Township	Range	Section	Quarter Sections
29N	22W	8	SE¼ SE¼
County			Geocode
FLATHEAD			
Latitude	Longitude	Geomethod	Datum
48.285628	114.420254	TRS-SEC	NAD83
Altitude	Method	Datum	Date

\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.

## Section 8: Remarks

**Addition** **Block** **Lot**

## Section 3: Proposed Use of Water

DOMESTIC (1)

## Section 4: Type of Work

Drilling Method: ROTARY

## Section 5: Well Completion Date

Date well completed: Tuesday, June 30, 1998

## Section 6: Well Construction Details

### Borehole dimensions

From	To	Diameter
0	20	10
20	78	7
78	235	6

### Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint Type
-2	153	6			STEEL
130	235	5			STEEL

### Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
227	233	5	1/4X4		TORCH CUTS

### Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

## Section 9: Well Log

### Geologic Source

112ALVM - ALLUVIUM (PLEISTOCENE)

From	To	Description
0	75	BOULDERS AND GRAVEL
75	78	GRAVEL CLAY AND SEEPAGE
78	150	BROWN CLAY GRAVEL AND COBBLES
150	158	GREEN BOULDER
158	208	BROWN CLAY AND GRAVEL
208	235	CEMENTED GRAVEL AND WATER

## Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:**

**Company:** BILLMAYER DRILLING

**License No:** WWC-69

**Date**

**Completed:** 6/30/1998







## Other Options

**Plot this site on a topographic map**

## Section 7: Well Test Data

Total Depth: 235  
Static Water Level: 185  
Water Temperature:

### Air Test \*

20 gpm with drill stem set at      feet for 1 hours.  
Time of recovery      hours.  
Recovery water level      feet.  
Pumping water level 230 feet.

*\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

## Section 9: Well Log

**Geologic Source**  
112ALVM - ALLUVIUM (PLEISTOCENE)

[illegible]

## Printer Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
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**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

**Name:**  
**Company:** BILLMAYER DRILLING  
**License No:** WWC-69  
**Date** 6/30/1998  
**Completed:**

## Other Options

**Plot this site on a topographic map**

Section 7: Well Test Data

Total Depth: 36  
Static Water Level: 28  
Water Temperature:

### Pump Test \*

Depth pump set for test    feet.  
650 gpm pump rate with    feet of drawdown after    hours of  
pumping.  
Time of recovery    hours.  
Recovery water level    feet.  
Pumping water level 31 feet.

*\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

## Section 9: Well Log

### Geologic Source

1120TSH - GLACIAL OUTWASH (PLEISTOCENE)

[illegible]

### Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

## Name: \_\_\_\_\_

Company: OWNER

**License No: -**

Date 7/24/1968

Completed: 7/24/1968

\_\_\_\_\_



## Other Options

**Plot this site on a topographic map**

Section 7: Well Test Data

Total Depth: 80  
Static Water Level: 50  
Water Temperature:

### Air Test \*

35 gpm with drill stem set at 100 feet for 4 hours.  
Time of recovery 10 hours.  
Recovery water level 100 feet.  
Pumping water level 65 feet.

*\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

Addition	Block	Lot
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## Section 9: Well Log

### Geologic Source

1120TSH - GLACIAL OUTWASH (PLEISTOCENE)

[illegible]

Date well completed: Wednesday, May 22, 1974

### Driller Certification

There are no borehole dimensions assigned to this well.

## Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	75	6				STEEL

There are no completion records assigned to this well.

**Annular Space (Seal/Grout/Packer)**

From	To	Description	Cont. Fed?
0	20	DRILL CUTTINGS	

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: \_\_\_\_\_

Company: BILLMAYER DRILLING

License No: WWC-5

Date 5/22/1974

Completed: 5/22/1974

**MONTANA WELL LOG REPORT****Other Options**

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

**Plot this site on a topographic map**

**Site Name:** BREWER DAVID S  
**GWIC Id:** 84524

**Section 7: Well Test Data**

Total Depth: 78  
Static Water Level: 78  
Water Temperature:

**Section 1: Well Owner****Owner Name**

BREWER DAVID S

**Mailing Address**

RT 3

**City**

KALISPELL

**State**

MT

**Zip Code**

59901

**Unknown Test Method \***

Yield 15 gpm.  
Pumping water level    feet.  
Time of recovery    hours.  
Recovery water level    feet.

**Section 2: Location****Township**

29N

**Range**

22W

**Section**

8

**Quarter Sections**

SW¼ SW¼

**County**

FLATHEAD

**Geocode****Latitude**

48.285628

**Longitude**

114.436893

**Geomethod**

TRS-SEC

**Datum**

NAD83

**Altitude****Method****Datum****Date**

*\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

**Section 8: Remarks****Addition****Block****Lot****Section 9: Well Log****Geologic Source**

112OTSH - GLACIAL OUTWASH (PLEISTOCENE)

**Lithology Data**

There are no lithologic details assigned to this well.

**Section 3: Proposed Use of Water**

DOMESTIC (1)

**Section 4: Type of Work**

Drilling Method: DRILLED

**Section 5: Well Completion Date**

Date well completed: Friday, February 01, 1946

**Section 6: Well Construction Details**

There are no borehole dimensions assigned to this well.

There are no casing strings assigned to this well.

There are no completion records assigned to this well.

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:**

Company: UNKNOWN

License No: -

Date: 2/1/1946

Completed:

## Other Options

**Plot this site on a topographic map**

Section 7: Well Test Data

Total Depth: 120  
Static Water Level: 90  
Water Temperature:

### Air Test \*

30 gpm with drill stem set at 100 feet for 1 hours.  
Time of recovery 1 hours.  
Recovery water level 100 feet.  
Pumping water level 115 feet.

10 WILLOWBROOK CLOSE

## Section 2: Location

Township	Range	Section	Quarter Sections
29N	22W	9	NE¼ SE¼
County			Geocode

FLATHEAD

<b>Latitude</b>	<b>Longitude</b>	<b>Geomethod</b>	<b>Datum</b>
48.28924	114.398616	TRS-SEC	NAD83
<b>Altitude</b>	<b>Method</b>	<b>Datum</b>	<b>Date</b>

Addition	Block	Lot R
----------	-------	----------

*\* During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

DOMESTIC (1)

### Section 8: Remarks

Drilling Method: ROTARY

## Section 9: Well Log

Date well completed: Tuesday, November 22, 1994

### Geologic Source

There are no borehole dimensions assigned to this well.

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	118	6				STEEL

There are no completion records assigned to this well.

### Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	18	BENTONITE	

1120TSH - GLACIAL OUTWASH (PLEISTOCENE)

[illegible]

## Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: \_\_\_\_\_

**Company:** SUDAN DRILLING

License No: WWC-450

**Date**

Date Completed: 11/22/1994



### Other Options

Plot this site on a topographic map  
View hydrograph for this site  
View water quality for this site



**ATTACHMENT D**  
**Photolog**

LOST CREEK FAN WELLS  
KALISPELL, MONTANA  
December 2007



3088 Clark



3248 FTM



1803 Church



1803 Church



84527



84526



LOST CREEK FAN WELLS  
KALISPELL, MONTANA  
December 2007



3745 FTM



3745 FTM



84524



84524



BREWER 120



2111 CHURCH



LOST CREEK FAN WELLS  
KALISPELL, MONTANA  
December 2007



1195 BRR



1195 BRR



193337



2686 WVD



165 LLR



165 LLR

LOST CREEK FAN WELLS  
KALISPELL, MONTANA  
December 2007



1481 CHURCH



137876



148209



137875



FENLEY



14210



LOST CREEK FAN WELLS  
KALISPELL, MONTANA  
December 2007



905 CLARK



ADREANI OLD



ADREANI OLD



2335 WVD-01



2335 WVD-02



84525